FAX: 39 40 224601 (1)

UNIVERSITY OF CAMBRIDGE
DEPARTMENT OF HISTORY AND PHILOSOPHY OF SCIENCE

FREE SCHOOL LANE
CAMBRIDGE CB2 3RH
TEL: CAMBRIDGE (01223) 334540
FAX: CAMBRIDGE (01223) 334554

PROFESSOR MICHAEL REDHEAD FBA
HEAD OF DEPARTMENT

5.11.95

Dear Gian Carlo,

Thank you for your fax dated 30th October. There is much in the new draft that I am happy to agree with, but there are a few points I would like to raise with you, for additional clarification.

(1) An essential part of your argument is that, modulo a no-conspiracy assumption, then OM-Loc ⊃ B-Loc (V (Sect. 4.ii of your paper)

From (1) you argue (Sect. 6.1)

Q.M. ∧ Compl. ⊃ ¬ B-Loc
⊃ ¬ OM-Loc, from (V.

But then, from the basic result

Q.M. ∧ Compl. ⊃ ¬ (OM-Loc) ∨ ¬ (FR-Loc)
(your 5.2)

it follows that one cannot derive ¬ (FR-Loc)

P.T.O.

DIRECT LINE: CAMBRIDGE (01223) 334556

and hence, by employing your notion of accessible properties, you can move to the claim that EPR-Loc holds.

I want to look at (1) a bit more carefully.

Since $B\text{-}Loc \equiv P.I. \wedge O.I.$

(1) can be recast as

$$QM\text{-}Loc \supset P.I. \wedge O.I.$$

from which it follows that

$$QM\text{-}Loc \supset P.I. \quad (2)$$

and $$QM\text{-}Loc \supset O.I. \quad (3)$$

Now (2) needs no 'no-conspiracy' assumption to justify it. (2) just says that if outcomes match on each occasion when the distant measurement is performed as compared with the situation when it is not performed, then there must be a corresponding match in the probabilities interpreted as long-run frequencies in the two situations.

But remembering that

$$Q.M. \wedge Compl. \supset P.I \quad (4)$$

and $$Q.M. \wedge Compl. \supset \neg O.I \quad (5)$$

it is (3) we must look at, not (2) for your argument to go through.

Now it is not at all clear to me how to justify (3) by using a 'no-conspiracy' assumption.

OM-Loc is concerned ~~to conceal~~ with comparing outcomes when a distant measurement is or is not performed. But O.I. is a 'screening off' condition between the outcomes of two measurements which are actually performed. I simply do not see how to connect the principle with the other. If we went for a moment to (2), then one could use a no-conspiracy argument to justify

P.I. ⊃ OM-Loc — (6)

The situation here is exactly like the relationship between STAT FUNC and FUNC (see my book, Incompleteness, Nonlocality and Realism, p. 132). We cannot derive FUNC from STAT FUNC, unless we use some assumption to the effect that probabilistic matching can only be expected to occur if cause by cause matching occurs

P.T.O.

But if we combine (4) and (6) then we would conclude

QM ∩ Compl. ⊃ QM-Loc

which, in conjunction with your 5.2 would imply

Q.M. ∩ Compl. ⊃ ¬(ER-Loc)

the very result you don't want!

Now, I am not advocating this line of argument. In the case of STAT FUNC and FUNC it leads to disaster, since STAT FUNC is a theorem of quantum mechanics and FUNC leads to logical contradiction (the Kochen-Specker paradox).

But the point for our paper, Gian Carlo, is that we must be very careful not to choose (6) rather than (3) by a no-conspiracy line of argument, and at the moment I don't see how to do this.

(2) Even if we have succeeded in demonstrating ¬ER-Loc, we still have to explain why ¬QM-Loc is not a difficulty for relativity.

clearly ¬ OM-Lee implies a form of parameter dependence at a case-by-case level, while preserving the probabilistic version of P.I. itself. This again could be argued to involve a conspiracy, viz. if case-by-case, parameter independence fails then how does it come about that the long-run frequencies are unchanged.?

'No-conspiracy' arguments have a habit of justifying things you don't want as well as things you do want!

I am eager to have your reactions to these comments.

With best wishes

Michael